Importation into the United States From Japan of Fresh *Zingiber mioga* Flowers, Leaves, and Stems for Consumption

Qualitative, Pathway-Initiated Pest Risk Assessment

January 1996

Agency Contact:

Biological Assessment and Taxonomic Support
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 133
Riverdale, MD 20737-1236

A. Introduction

This pest risk assessment was prepared by the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) to examine plant pest risks associated with the importation into the United States of fresh flowers, leaves and stems of mioga ginger, *Zingiber mioga* (Thumb.) Roscoe, grown in Japan. This is a qualitative pest risk assessment, that is, estimates of risk are expressed in qualitative terms such as high or low as opposed to a quantitative risk assessment which expresses risk in numerical terms such as probabilities or frequencies.

International plant protection organizations (*e.g.*, North American Plant Protection Organization (NAPPO) and the United Nations Food and Agriculture Organization (FAO)) provide guidance for conducting pest risk analyses. The methods we used to initiate, conduct, and report this plant pest risk assessment are consistent with guidelines provided by NAPPO and FAO. Our use of biological and phytosanitary terms (*e.g.*, introduction, quarantine pest) conforms with the *NAPPO Compendium of Phytosanitary Terms* (NAPPO 1995) and the *Definitions and Abbreviations* (Introduction Section) in *International Standards for Phytosanitary Measures, Section 1—Import Regulations: Guidelines for Pest Risk Analysis* (FAO 1995).

Pest risk assessment is one component of an overall pest risk analysis. The *Guidelines for Pest Risk Analysis* provided by FAO (1995) describe three stages in pest risk analysis. This document satisfies the requirements of FAO Stages 1 (initiation) and 2 (risk assessment).

The Food and Agriculture Organization (FAO, 1995) defines "pest risk assessment" as "Determination of whether a pest is a quarantine pest and evaluation of its introduction potential". "Quarantine pest" is defined as "A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled" (FAO, 1995; NAPPO, 1995). Thus, pest risk assessments should consider both the likelihood and consequences of introduction of quarantine pests. Both issues are addressed in this qualitative pest risk assessment.

This document presents the findings of our qualitative plant pest risk assessment. We have not described in detail our assessment methods or the criteria we used to rate the various risk elements. Details of our methodology and rating criteria can be found in our "template" document: ***Pathway-Initiated Pest Risk Assessment: Guidelines for Qualitative Assessments, version 4.0*** (USDA, 1995); to obtain a copy of our template, contact the individual named in the proposed regulations.

B. Risk Assessment

1. Initiating Event: Proposed Action

This pest risk assessment is commodity-based, and therefore "pathway-initiated"; we initiated the assessment in response to the request for USDA authorization to allow imports of a particular commodity presenting a potential plant pest risk. In this case, the importation of fresh mioga ginger, *Zingiber mioga*, grown in Japan into the U.S. is a potential pathway for introduction of plant pests. Quarantine 56 (7 CFR §319.56) provides a general regulatory authority for importation of fruits and vegetables.

Mioga ginger is a member of the genus Zingiber. There are 85 species within the genus and they grow

in tropical regions of the world (Mabberley, 1990). Mioga ginger is a perennial herb cultivated in Japan, the rhizomes are the source of Japanese ginger. The young flowers, fruits and sprouts are eaten in Japan. (Uphof, 1968)

2. Assessment of Weediness Potential of Japanese Mioga Ginger

Table 1 shows the results of our weediness screening for *Zingiber mioga*. These findings did not require us to initiate a pest-initiated pest risk assessment.

Table 1: Process for Determining Weediness Potential of Commodity

Commodity: *Zingiber mioga*, flowers, leaves, and stems

Phase 1: Although there are several species of *Zingiber*, apparently *Zingiber officinale* is the only cultivated species in Florida and Hawaii.

Phase 2: Is the species listed in:

NO	*Geographical Atlas of World Weeds* (Holm, 1979)
NO	*World's Worst Weeds* (Holm, 1977)
NO	*Report of the Technical Committee to Evaluate Noxious Weeds; Exotic Weeds for Federal Noxious Weed Act* (Gunn & Ritchie, 1982)
NO	*Economically Important Foreign Weeds* (Reed, 1977)
NO	Weed Science Society of America list (WSSA, 1989)
NO	Is there any literature reference indicating weediness (*e.g.*, *AGRICOLA*, *CAB*, *Biological Abstracts*, *AGRIS*; search on "species name" combined with "weed").

Phase 3: Conclusion:

This commodity does not pose a significant risk as a weed.

3. Previous Risk Assessments, Current Status and Pest Interceptions

3a. Decision history for mioga ginger:

Japan - 1984: Entry of mioga ginger bracts permitted into Guam subject to inspection.

3b. Interceptions from China, Japan & Korea FY 85-95

HOST	ORIGIN	PEST
ZINGIBER OFFICINALE (ROOT)	JAPAN(?)	ASPIDIELLA HARTII
ZINGIBER OFFICINALE (ROOT)	JAPAN	APHIDIDAE, Species of
ZINGIBER OFFICINALE (ROOT)	JAPAN	ASPIDIELLA HARTII
ZINGIBER OFFICINALE (ROOT)	KOREA(?)	ASPIDIELLA HARTII
ZINGIBER OFFICINALE (ROOT)	REPUBLIC OF CHINA	ASPIDIELLA HARTII
ZINGIBER OFFICINALE (ROOT)	REPUBLIC OF CHINA	IPOMOEA TRILOBA
ZINGIBER OFFICINALE (ROOT)	REPUBLIC OF CHINA	PSEUDOCOCCIDAE, Species of
ZINGIBER SP. (ROOT)	JAPAN(?)	ASPIDIELLA HARTII
ZINGIBER SP. (ROOT)	KOREA	DIASPIDIDAE, Species of
ZINGIBER SP. (ROOT)	KOREA	DIPTERA, Species of
ZINGIBER SP. (ROOT)	REPUBLIC OF CHINA	APHIDIDAE, Species of
ZINGIBER SP. (ROOT)	REPUBLIC OF CHINA	ASPIDIELLA HARTII
ZINGIBER SP. (ROOT)	REPUBLIC OF CHINA	COCCIDAE, Species of
ZINGIBER SP. (ROOT)	REPUBLIC OF CHINA	PSEUDOCOCCUS SP.

4. Pest List: Pests Associated with Zingiber in Japan

Table 2 shows our pest list for Japanese *Zingiber*. As few pest were reported for *Z. mioga*, we developed the pest list for the generic level We generated the list after review of the information sources listed in USDA (1995). The pest list includes limited information on the distribution of each pest, pest-commodity association, and regulatory history.

Table 2: Pest List - *Zingiber* spp.

Scientific Name, Classification	Distribution[1]	Comments[2]	References
Arthropods			
Agrotis ipsilon Hufnagel (Lepidoptera: Noctuidae)	JP,US	z	Anon., 1980; Hill, 1987
Agrotis segetum Denis & Schiffermuller (Lepidoptera: Noctuidae)	JP	m,z	Anon., 1957; Anon., 1980; Hill, 1987; Carter, 1984
Anomala cuprea Hope (Coleoptera: Scarabaeidae)	JP	e	Anon., 1980; Hill, 1986
Conogethes punctiferalis (Guenee) (Lepidoptera: Pyralidae)	JP	m	FAO, 1993
Mamestra brassicae Linne (Lepidoptera: Noctuidae)	JP	m	Anon., 1980; Hill, 1987

Ostrinia furnacalis (Guenee) (Lepidoptera: Pyralidae)	JP	z	Nafus & Schreiner, 1991; Anon., 1980
Sesamia inferens Walker (Lepidoptera: Noctuidae)	JP	z	Anon., 1980; Hill, 1987
Spodoptera litura Fabricius (Lepidoptera: Noctuidae)	JP	z	Anon., 1980; Hill, 1987
Zeuzera leuconotum Butler (Lepidoptera: Cossidae)	JP	m,z	Anon., 1980; Hill, 1987
Fungi			
Cercospora zingiberi Togashi & Katsuki (Fungi Imperfecti: Hyphomycetes)	JP	z	Watson, 1971; Chupp, 1953
Fusarium oxysporum Schlechtend.:Fr. f.s. *zingiberi* Trujillo (Fungi Imperfecti: Hyphomycetes)	JP, HI	m,z	Cook, 1978; Raabe *et al.*, 1981
Helicobasidium mompa Tan. (Basidiomycetes: Auriculariales)	JP	a	Watson, 1971; Holliday, 1980
Mycosphaerella zingiberi Shirai (Loculoascomycetes: Dothideales)	JP	z	Stevenson, 1926; Fujioka, 1952
Phyllosticta zingiberi (Hori)(Fungi Imperfecti: Coelomycetes)	JP	m	Stevenson, 1926
Pyricularia zingiberi Nish. (Fungi Imperfecti: Hyphomycetes)	JP	z	Stevenson, 1926; Fujioka, 1952; Watson, 1971; Kotani *et al.*, 1992
Pythium zingiberum Takahashi (Oomycetes: Peronosporales)	JP	m	Hokama, 1992; Ichitani & Shinsu, 1981
Taphrina maculans Butler (Hemiascomycetes: Taphrinales)	JP	z	Stevenson, 1926; Fujioka, 1952; Sivanesan & Gibson, 1976
Bacteria			
Erwinia carotovora subsp. *carotovora* (Jones) Bergey *et al.*	JP,US	c,m	Bradbury, 1986
Pseudomonas solanacearum (Smith) Smith	JP,US	c,m	Bradbury, 1986

Viruses			
Cucumber mosaic virus	JP,US	c	Anonymous, 1980; Smith, 1972
Nematodes			
Meloidogyne arenaria Neal	JP,US	a,c,m	Anon., 1984; Anon., 1980
Meloidogyne hapla Chitwood	JP,US	a,c,m	Anon., 1980; Anon., 1984
Meloidogyne incognita Kofoid et White	JP,US	a,c,m	Anon., 1980; Anon., 1984
Meloidogyne javanica Treub.	JP,US	a,c,m	Anon., 1980; Anon., 1984
Tylenchorhynchus nudus Allen	JP,US	a,c,m	Anon., 1980; Anon., 1984
Xiphinema insigne Loos	JP	a,c,m	Anon., 1980;

1 Distribution legend: KS = Korea; US = United States; HI = Hawaii

[2] Comments: a = Pest mainly associated with a plant part other than the commodity.
c = Organism does not meet the geographical and regulatory definition for a quarantine pests (NAPPO; FAO)
e = Although pest attacks commodity, it would not be expected to remain with the commodity during processing
m = Reported to occur in the PRA area, but not on the specified commodity
z = Pest is known to attack or infest *Zingiber mioga* and it would be reasonable to expect the pest may remain with the commodity during processing and shipping

5. List of Quarantine Pests

Our list of quarantine pests for commercial shipments of *Zingiber mioga* flowers, leaves, and stems from Japan is provided in Table 2. Should any of these pests be intercepted on commercial (or any other) shipments of *Z. mioga*, quarantine action may be taken.

Table 3: Quarantine Pests: Japanese *Zingiber mioga* flowers, leaves, and stems for consumption

Arthropods	*Agrotis segetum* Denis et Schiffermuller
	Anomala cuprea Hope
	Ostrinia furnacalis (Guenee)
	Sesamia inferens Walker
	Spodoptera litura Fabricius
	Zeuzera leuconotum Butler
Fungi	*Cercospora zingiberi* Togashi & Katsuki
	Helicobasidium mompa Tan.
	Mycosphaerella zingiberi Shirai
	Pyricularia zingiberi Nish.
	Taphrina maculans Butler

6. Quarantine Pests Likely to Follow Pathway (*i.e.*, Quarantine Pests Selected for Further Analysis)

A description of the criteria that pests must satisfy to be considered for further analysis can be found in USDA (1995).

Table 4: Quarantine Pest Selected for Further Analysis: Japanese *Zingiber mioga* flowers, leaves, and stems for consumption

Arthropod	*Agrotis segetum* (Denis & Schiffermuller)
	Ostrinia furnacalis Guenee
	Sesamia inferens Walker
	Spodoptera litura Fabricius
Fungi	*Cercospora zingiberi* Togashi & Katsuki
	Mycosphaerella zingiberi Shirai
	Pyricularia (Piricularia) zingiberi Nish.
	Taphrina maculans Butler

7. Economic Importance: Consequences of Introduction

For each quarantine pest selected for further analysis, we consider the consequences of introduction. For qualitative, pathway-initiated pest risk assessments, these risks are estimated by rating each pest with respect to five risk elements. A full description of these elements and rating criteria can be found in USDA (1995). Table 5 shows our risk ratings for these risk elements. Please refer to Table 2 page 10 in the PRA Process document ver. 4.0 for an interpretation of the rating scores high, medium, and low.

Table 5: Risk Rating: Consequences of Introduction

Pest	Climate/ Host	Host Range	Dispersal	Economic	Environ-mental	Risk Rating
Agrotis segetum	high	high	low	medium	medium	medium
Ostrinia furnacalis	high	high	medium	high	medium	high
Sesamia inferens	high	medium	low	medium	medium	medium
Spodoptera litura	high	high	low	medium	medium	medium
Cercospora zingiberi	medium	low	low	medium	medium	medium
Mycosphaerella zingiberi	medium	low	low	medium	medium	medium
Pyricularia zingiberi	medium	low	low	medium	medium	medium
Taphrina maculans	medium	low	low	medium	medium	medium

8. Likelihood of Introduction

For each quarantine pest selected for further analysis, we consider the likelihood of introduction. For qualitative, pathway-initiated pest risk assessments, these risks are estimated by rating each pest with respect to six risk elements. A full description of these elements and rating criteria can be found in USDA (1995). Table 6 shows our ratings for these risk elements.

Table 6: Risk Rating: Likelihood of Introduction

Pest	Quantity of commodity imported annually	Likelihood survive postharvest treatment	Likelihood survive shipment	Likelihood not detected at port of entry	Likelihood moved to suitable habitat	Likelihood find suitable host
Agrotis segetum	low	low	high	medium	low	low
Ostrinia furnacalis	low	high	high	medium	medium	medium
Sesamia inferens	low	medium	low	medium	low	medium
Spodoptera litura	low	high	high	medium	medium	medium
Cercospora zingiberi	low	medium	high	low	low	low
Mycosphaerella zingiberi	low	medium	high	low	low	low
Pyricularia zingiberi	low	medium	high	low	low	low
Taphrina maculans	low	medium	high	low	low	low

With these risk ratings, we rate the cumulative likelihood of introduction of each of these quarantine pests as follows: Please see Table 5 page 11 of the PRA Process document ver. 4.0 dated 11/19/95 for an interpretation of the risk rating scores.

Agrotis segetum - low risk
Ostrinia furnacalis - medium risk
Sesamia inferens - low risk
Spodoptera litura - medium risk
Cercospora zingiberi - low
Mycosphaerella zingiberi - low
Pyricularia zingiberi - low
Taphrina maculans - low

9. Conclusion: Pest Risk Potential and Phytosanitary Measures

Our measure of pest risk potential combines the risk ratings for consequences and likelihood of

introduction as described in USDA (1995). Table 7 shows our estimated pest risk potential for the quarantine pests selected for further analysis for importation of Japanese *Zingiber mioga* flowers, leaves, and stems. Please see Table 6, page 13 of the PRA Process document ver. 4.0 dated 11/19/95 for an interpretation of the rating scores.

Table 7: Pest Risk Potential, Quarantine Pests, Japanese *Zingiber mioga* flowers, leaves, and stems

Pest	Pest risk potential
Agrotis segetum	medium
Ostrinia furnacalis	high
Sesamia inferens	medium
Spodoptera litura	medium
Cercospora zingiberi	medium
Mycosphaerella zingiberi	medium
Pyricularia zingiberi	medium
Taphrina maculans	medium

For pests receiving a PRP risk rating of high (*i.e., Ostrinia furnacalis*), we recommend specific phytosanitary measures, port-of-entry inspection may not be sufficient to provide phytosanitary security. Many polyphagous insects occur in Japan, several of them are quarantine pests and have been intercepted as hitchhikers with other commodities. However, these external pests listed can be detected by inspection.

Detailed examination and choice of appropriate sanitary and phytosanitary measures to mitigate pest risk for particular pests is undertaken as part of the pest risk management phase and is not discussed in this document. APHIS has not yet determined whether risks associated with importations of mioga ginger from Japan can be managed adequately. Nor has it been determined what measures would be used to manage plant pest risk should APHIS proceed with a proposed rule for importations. APHIS' final decisions regarding importation of mioga ginger will be based on the results of a complete pest risk analysis. This pest risk assessment is the first stage of the risk analysis and constitutes a primary tool for risk management.

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John Lightfield
Biological Assessment and Taxonomic Support
Plant Protection and Quarantine
January 1996

Reviewed by:

G. Cave
M. Firko
E. Podleckis
S. Redlin
R. Stewart